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# The use and significance of machine learning to screen COVID-19

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**ABSTRACT**

Coronavirus disease 2019 (COVID-19) virus was first seen in 2019 December in China and rapidly spread all over the world and millions of people are infected with this virus. This disease has sited the entire world in dangerous circumstances. At the start of this virus, it was a very serious matter in China but now it is being observed all over the world. The virus is life-threatening, and other public who are affected by previous diseases or those people whose age is more than 60 are more affected by this virus. The healthcare and drug industries have tried to find a treatment. While machine learning algorithms are largely applied in other areas, at this time every health care unit has to want to use machine learning techniques to find, predict, track, and screen the spread of COVID-19, and try to find the treatment of it. we show what is the journey of machine learning to find and track COVID-19 and also observing it from a screening and detecting the COVID-19. We show how much research has been done yet to detection of COVID-19 and which algorithm of machine learning is best for the detection and screening of the COVID-19.



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## 1. INTRODUCTION

Coronavirus disease 2019 (COVID-19) was first seen in China (Wuhan) in December 2019. It is a global virus and may easily infect people and spread from person to person [1]. The Centers for Disease Control and Prevention (CDC) [2] said that those people who are affected with this virus show multiple signs like breathing problems, dry cough, tiredness, sense of taste has lost and smell, and blocking of blood, diarrhea. Sick patients can also present with fever. Strangely sufficient, most of the patients who have to decrease the virus will not even demonstrate any of the above-mentioned signs. All people who are affected can feel usual carrying this virus and without knowing they spread the disease. As we know that the type of virus is spread very easily from one person to another person. At the start of March 2020, the World Health Organization (WHO) officially declared it as a universal disease. In June 2021, the total number of confirmed cases of COVID-19 in the world was over 174,918,667 [3]. To control this kind of pandemic different scientific methods are used to detect and diagnose such type of pandemic.

The deep learning (DL) techniques [4], Internet of things (IoT) [5], big data [6], machine learning [7], and blockchain [8] can use for screening and detecting COVID-19. Ahishali *et al*. [9] use these techniques for screening and monitoring COVID-19 and sensing the virus, or also design for making a vaccine to fight this virus. In the past, we see two epidemics like this including middle eastern respiratory syndrome (MERS) and severe acute respiratory syndrome (SARS-CoV) [10]. SARS-CoV may be a respiratory worm that was transferred from person to person. This virus was first seen in China in the end of

February 2003. Machine learning, as a subdivision of artificial intelligence (AI), is the use of machine learning in all of the industries like pharmaceuticals, healthcare, marketing, cybersecurity, banking, agriculture, and business. Machine learning methods are often automated to copy human intelligence. For example, in the healthcare domain, machine learning algorithms and techniques are often used towards screening and diagnosis of the COVID-19. Machine learning models are immensely trained according to dataset containing clinical images like magnetic resonance imaging (MRI) [11], X-ray [12], computerized tomography (CT) scan [13], or to notice irregularities. Machine learning algorithms are also used in different areas like diabetes, fatty life, cancer. As an example, in forecasting breast cancer, machine learning algorithms give good results and forecast accuracy of 97.13% [14].

Through earlier waves of such disease, machine learning algorithms and techniques are generally applied to help healthcare professionals and all those authorities who decide to fight and screen this type of virus. Machine learning also has been broadly used to improve medical decision-making concerning the present COVID-19 universal disease. Remarkably, in most of the time, machine learning techniques enabled the researchers to screen and detect COVID-19 via image classification methods to facilitate healthcare professionals to diagnose COVID-19. To find a treatment for COVID-19, machine learning algorithms are also used for even making vaccines and drug detection. In this survey paper, we present the latest research toward detecting and diagnose to COVID-19. We examine the role of machine learning algorithms in screening and detecting the virus.

In this paper, we see multiple papers that use different machine learning algorithms to screen out COVID-19 pandemic and multiple algorithms give different accuracy and result on different datasets. The use of machine learning in this pandemic is more important because of previous pandemic time the use of machine learning plays an important role to find and screen viruses that affect human life. Therefore, we want to give a complete review about all machine learning algorithms that play role in screening and diagnosis that virus. We find that multiple algorithms give good accuracy and give good results. This paper is divided into six sections. Section 1, introduction, gives detailed information about our paper and why machine learning algorithms are important for COVID-19. Section 2 presents how different machine learning techniques use for screen out and diagnosis COVID-19. Section 3 presents a literature review on various algorithms that are used to screen and diagnose COVID-19. The methodology used to conduct this research paper is shown in section 4. The results and discussion are present in section 5, and finally, in section 6, we conclude our work.

## 2. MACHINE LEARNING TECHNIQUE TOWARDS COVID-19

Every disease has its symptoms and different screening methods. When we see COVID-19 in 2019 in China, everyone does not know yet how to prevent and screen for this virus. Different methods and techniques are used in the earlier stage for COVID-19 detection and screening but most of them do not give good results and accuracy. One of the methods used in the beginning of this pandemic is the reverse transcription polymerase chain reaction (RT-PCR) test that gives good results and short periods. Its accuracy and screening method are very simple, so that everyone wants to use this method to screen COVID-19 [15]. The RT-PCR test is a swab test used to detect nucleic acid from COVID-19 patients inside the lower and upper respiratory system. When this pandemic started, the disadvantage of the RT-PCR test is that one who tests negative starts later confirmed positive.

Overall, machine learning methods are extensively used within the healthcare area and likewise, they are regularly used to examine patient data and identify COVID-19. In this research paper, we review multiple machine learning algorithms that have been applied for the diagnosis and screening of COVID-19 by using multiple types of medical imaging which contains CT-scan pictures and X-rays. Furthermore, we also discuss several machine learning-based techniques including AI, IoT, and chatbots.

### 2.1. Healthcare images

Screening and detecting any disease are the most important part of the healthcare system. Most healthcare systems use medical images for screening and detecting COVID-19. Therefore, we also use medical imaging the RT-PCR test for detecting and screening COVID-19. It is more important when we use these approaches as it gives more reliable and accurate results. Overall, medical imaging sensory system similar CT-scan and chest X-ray it plays important contributions in detecting and screening and also diagnosis of COVID-19. Multiple machine learning methods that integrate CT-scan and X-ray image processing methods could help healthcare experts in detecting and screening COVID-19.

### 2.2. X-ray

When we say to detect covid-9 with medical imaging the first thing that comes to mind is chest X-ray [9] which is one of the most used methods to detect and screen COVID-19. Throughout this epidemic, the use of chest X-ray imaging plays an important part in the early screening and detection of COVID-19 to

categorize the infected and normal chest due to its low radiation, low cost, and the ability to give fast results. That is why every researcher and doctor want to use X-rays to detect and screen COVID-19 with this low-cost tool. Therefore, Italian Society of Medical Radiology (SIRM) recommends the use of X-ray for detecting and screening COVID-19. The data sets of X-ray use in screening and detecting COVID-19 affected persons. The healthcare system uses these tools for detecting and screening COVID-19 patients because of its low price and fast process to screen out COVID-19 patient. We see most researchers use X-ray data sets for researcher purposes from different sources and give good accuracy and results and predict to COVID-19 with machine learning algorithms.

### 2.3. CT-scan

During COVID-19, another application of medical imaging techniques for detecting and diagnosis COVID-19 is chest CT, which gives more accurate results in screening and detecting COVID-19. The breathing problem of patience due to COVID-19 includes lungs anomaly, therefore the use of CT-scan can be more important for screening and detecting process as the initial phase of a pandemic although there were no symptoms that appear in any person which is affected with COVID-19. In this research paper, we see all machine learning algorithms that are used for detecting and diagnosis COVID-19 and which ones give better results and accurate results in a short time. Therefore, CT-scan is a very useful tool for screening and detecting COVID-19.

### 2.4. Chatbot

Most of the computer devices are programmed to communicate with humans by using natural human language is called chatbots. These programmed machines can interconnect with multiple users and give proper answers to those users who use give proper input to this kind of device. In this COVID-19 pandemic time, we use different types of chatbots and work with different kinds rather than the hotline communication method. With the use of this kind of technology the visitor of the hospital easily communicates with the doctor rather than visiting a hospital, therefore, the rush of a hospital is decreased, and communication became more efficient. Usually, it is humane to use chatbots for communication with doctors via video call or voice call and using different tools likewise smartphone, channel, and web application by using chatbots [16]. The patients can make intersection with doctors using this kind tools there are multiple advantages of chatbots including giving more accurate and quick information. The use of machine learning constructed chatbots are giving better quality throughout the training process when we give more data it gives more accurate results.

### 2.5. Internet of things

When we say about office automation the word that comes to mind is IoT. IoT makes the world automatic because most of its work or done by automatic therefore the practices of the IoT and AI in the business automation process or increasing day by day. Throughout this COVID-19 pandemic, IoT and AI [17] are more used in healthcare systems where detecting and screening processes can be done more accurately by these techniques. Social distance monitoring and medical imaging are two tools to use for detecting and screening the COVID-19 pandemic. The major goals of using this kind of device are face mask screening, temperature measure, distance controlling, screening and detection, of COVID-19 [18].

## 3. LITERATURE REVIEW

Machine learning algorithms has been useful in various research, particularly since the outgoing COVID-19 plague, to detect and screen such types of viruses and forms and awareness leading or associated with the infection. Therefore, most researchers and universities are using machine learning to detect and screen COVID-19 affected persons. This paper will show how much research has been done and researcher published researcher papers for detection and screening to COVID-19. Dutta and Bandyopadhyay [19] used deep learning neural network concept use for screening and detecting of COVID-19 cases by using these algorithms, the others used gated recurrent unit (GRU) and long short-term memory (LSTM) that are similarly integrated for training the dataset and therefore the forecast results are count with the results by medical results. In the paper, the forecast data are showed towards the real records primarily based on a few predefined guidelines. The trial effects display that the purposed method is beneficial in generating appropriate results based at the outbreak of the crucial ailment. The LSTM provides 76.6% accuracy and GRU provides 76.9% accuracy and then they combined both models to give good results and 87% accuracy. Therefore, they proposed a combined model for the screening of COVID-19.

Yang *et al.* [20] proved that CT-scans are capable of providing that fast, exact, and low-priced detecting and testing of COVID-19 disease. They gather data set containing 275 CT-scans that show positive results of COVID-19. To fasten the development process and research purpose, they used deep learning

algorithms which guess whether a person is affected with COVID-19 by examining the CT-scans. They collected different CT-scan results from different labs include medRxiv and bioRxiv. They proposed two methods: data augmentation (DA) and transfer learning. These two algorithms give good results for screening and diagnosing COVID-19. The purpose of transfer learning is to control a large collection of data from a related field to help with the learning in the concerned field and it gives 84.7% accuracy. Batista *et al.* [21] used machine learning approaches for detecting COVID-19 patience which is different machine learning algorithms use for this purpose. The simple data collected from a hospital in Brazil. They collect 235 adult patients from the hospital who receive 43% positive from RT-PCR tests. Five machine learning of algorithms were used for this diagnosis, but the great predictive overall performance turned into acquired by using support vector machine (SVM) were on a random pattern of 70% of the sufferers, and overall performance turned into tested on new unseen information 30%. The quality predictive performance became acquired via use of support vector system is accuracy 85%, sensitivity 68%, and specificity 85%.

Eljamassi and Maghari [22] showed that multiple types of research by multiple researchers used different algorithms and show different results, and most countries use PCR tests, although it takes a long time to show results. We read the paper that suggested a machine learning algorithm: SVM, k-nearest neighbor (k-NN), and random forests (RFs). The datasets contained chest X-ray images of normal people, with pneumonia such as SARS, streptococcus. The images features are extracted using the histogram of oriented. Almansoor and Hewahi [23] investigated different machine learning algorithms to discover the relation of blood tests with the COVID-19 pandemic. They used *k*-NN, AdaBoost, RF, and SVM. They obtained data sets from a Brazilian hospital that has been used to test the algorithms that used in this research. The dataset was initially suffering from disturbing this forced us to balance the data using under-sampling. Scikit-Learn and other data science Phthon/R libraries have been used for this research. The accuracy rate is highest of adaptive bosting is 85%, SVM is 70%, RF gain 76% and K-nearest neighbors gain 78% accuracy.

Abdulkareem *et al.* [24] retrieved datasets on the COVID-19 world vaccine progress and have processed this information using four algorithms (decision tree, *k*-NN, random tree, and naive bayes) classification algorithms found in the WEKA data mining tool. Data mining algorithm performance assessment is important since it helps the user to pick the suitable algorithms for their classification activities. The final results after the datasets on the WEKA software calculate the accuracy for each classification algorithm shows that the best algorithms based on our data are the decision tree classifier with an accuracy of 99.9%, naive Bayes gives 69.74%, *k*-NN give 81.26% and random tree 96.71%.

Singh *et al.* [25] showed how IoT is used for COVID-19. IoT-enabled healthcare system is useful for proper monitoring of COVID-19 patients. This technology helps to increase patients' citification and reduce the readmission rate in the hospital. IoT is a well-defined scheme of interconnected computing digital and mechanical devices passing the capability of transmission of data without having any human involvement at any level. IoT in COVID-19 gives less expensive results, superior treatment, effective control, and enhanced diagnosis. Therefore, IoT has a good effect on any field of computer. All medical devices are connected to the internet during any critical situation. It automatically gives a message to the medical staff; infected cases can be handled with well-connected devices.

Sharma *et al.* [26] showed how the application of machine learning and deep learning is used for the detection of COVID-19. These results are different from each other. Deep learning model is used for X-ray diagnose to have a look at the affected areas of the frame as cancers, bone issues, accidents, and lung diseases. CNN-primarily based models ResNet-50, Inception-v3, and Inception-ResNet-v2 have been used to predict covid-9 patients with chest X-ray pix through. ResNet-50 had the best detection accuracy 98%. Further deep gaining knowledge of algorithms and SVM are used to categories the images as wholesome or inflamed by the function extraction procedure with chest X-ray snap shots. Various deep learning models like inception v3, ResNet-50, Google Net, ResNet-101 were used and done a 95.30% accuracy with ResNet50 and SVM.

Khanday *et al.* [27] collected multiple clinical results and use different approaches to detecting COVID-19. They used 212 clinical reviews which are classified in 4 training particularly COVID SARS, ARDS, and both (COVID, ARDS). Using various features like term frequency inversed document frequency (TF/IDF), a bag of words is being extracted from these medical reports. The machine learning algorithms are used for classification, it was revealed that logistic regression and multinomial naive Bayesian classifier give top notch outcomes by way of having 94% precision, 96% accuracy. Various other gadget gaining knowledge of algorithms that confirmed better results had been, SVM 90.6% and decision tree 92.5%. The efficiency of a version may be improved with the aid of growing the quantity of records. They suggest that if gather greater information the effects additionally enhance.

The data shown in the Table 1 represent different algorithms like SVM, RF, *k*-NN, decision tree, and gradient boosting machines. All these machine learning algorithms show different results on different data sets. The values in the table taken from various research papers and journals then take different techniques to detect and screen COVID-19 cases. The results are different in each article and use different machine learning approaches and algorithms. We show almost eleven different research paper and their data

set that are taken from multiple places and then use machine learning algorithms to calculate results and accuracy. All research papers show different accuracy and results on bases of data sets then a category all these research articles in five sections first is references columns and second is techniques use in research papers and third is data sets that are taken to calculate results and on basis of these data sets and forth is algorithms that use in a research paper and last is show accuracy that is taken from various research papers.

All these research papers show almost the same algorithms to calculate results but a few of them give 98% accuracy by using SVM algorithms with real-world masked face dataset (RMFD) but others give less accuracy than these two algorithms. All these machine learning algorithms are used in screening and detecting COVID-19 and give good results by using almost all imaging data sets and blood tests. Machine learning has nowadays become the most popular technology to detect COVID-19 patients more accurately and faster diagnose. Therefore, the use of machine learning algorithms is more and more in labs and research purposes in different universities and researchers.

Table 1. The different algorithms that use in COVID-19

| Ref | Technique | Data Set | Algorithms | Accuracy |
|---|---|---|---|---|
| [19] | Deep Learning Neural Network concept use for detection of COVID-19 | Data risk (2020, March) | LSTM | 76.6% |
| | | | GURU | 76.9% |
| | | | LSTM and GRU | 87% |
| [20] | Transfer learning and data augmentation | CT-scans | Transfer Learning | 84.7% |
| [21] | Machine learning algorithms | RT-PCR Test | SVM | 85% |
| | | | RF | 84.7% |
| | | | *k*-NN | 84.4% |
| | | | Linguistic Geometry | 84.3% |
| | | | GBT | 82.2% |
| [22] | Three machine learning algorithms | X-ray | SVM | 98.14% |
| | | | RF | 88.89% |
| | | | *k*-NN | 96.29% |
| [23] | Machine learning algorithms | Blood Test | Adoptive Bosting | 85% |
| | | | SVM | 70% |
| | | | RF | 76% |
| | | | *k*-NN | 78% |
| [24] | World vaccination process using machine learning algorithms | WHO Data | Decision Tree | 99% |
| | | | Random Tree | 96.71% |
| | | | *k*-NN | 81.26% |
| | | | Naive Bayes | 69.74% |
| [26] | Machine learning and deep learning were used for the detection of COVID-19 | X-ray | ResNet-50 | 98% |
| | | | SVM | 95.30% |
| [27] | Machine learning approaches | Clinical data from GitHub | Naive Bayesian | 96.2% |
| | | | SVM | 90.6% |
| | | | Decision Tree | 92.5% |
| [28] | Hybrid model using deep and classical Machine learning | RMFD dataset consists of 90,000 unmasked faces | SVM in RMFD | 99.64% |
| | | | SVM in SMFD | 99.98% |
| [29] | Machine learning approaches | RT-PCR test from Brazil hospital | Logistic Regression | 89.61% |
| | | | Decision Tree | 83.11% |
| | | | RF | 94.80% |
| | | | ADA Boosting | 93.50% |

## 4. METHODOLOGY

The method to complete this survey paper is searching many research papers from 2019 to 2021. Every research paper used different algorithms of machine learning to screen COVID-19. Most of the research in machine learning after COVID-19 uses different algorithms and therefore the search is done using different keywords according to our research paper and then we look at all the research that has been done before. PubMed provides updated studies papers in the field of computer technology and digital and all application of computer and engineering. Internet of technology is an extremely reliable asset on social technological know-how, engineering, technology, arts, humanities. Scopus is a dependable resource in exceptional regions of studies including medical, health, technology, generation, and engineering. These three databases cover all educational data of COVID-19. The final results of this literature review can assist save lives using imparting deep insights into this disease, existing scientific diagnosis structures for this virus, and recommended solutions for growing dependable medical systems.

### 4.1. Search criteria

We read all papers and then select some of them that are according to our criteria and according to our keywords and then give a literature review of all of them, all papers use different machine algorithms like

SVM, decision tree, LSTM, GRU, and *k*-NN to detect COVID-19 cases. The researcher tried only to include those published peer-review papers and expected peer-point motivated on papers from following journals and conferences: PubMed, Web of Sciences, and Scopus.

These key values are used to get research papers that are close to our research topic and therefore it is very easy to get valuable research we got that is necessary for our research like the present study. Diagnosing and screening COVID-19 using machine learning algorithms from November 2019, August 2021 and most relevant research have been done and get from three databases. All these resources provide enough data to use in our article and give references and most of the data related to our topic.

### 4.2. Data extraction

Most related research work and details and their methods used in that research papers, along with their outcomes, were confirmed in data extraction. Data collections and extraction is shown in Figure 1. The identified machine learning algorithms their results were shown in the data extraction phase. The major problem of facing data extraction is multiple researchers use the same type of datasets and same machine learning algorithms used for screening viruses.

It becomes difficult to get papers that show the best accuracy and use the same algorithms for screening COVID-19. Therefore, preferred reporting items for systematic reviews and meta-analyses (PRISMA) diagram is used to show how we select different research papers on multiple search engines like Google Scholar, PubMed, Scopus, and Web of Sciences. The research paper is enough for our research paper that gets from these resources. We extract data from different papers and see different algorithms that give high accuracy and results.

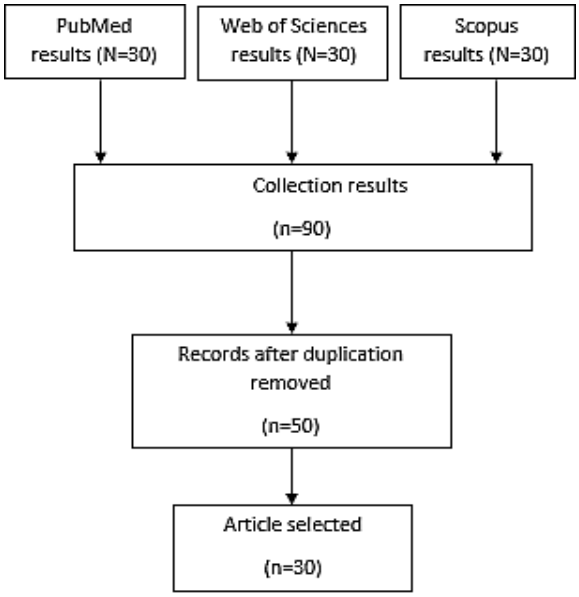


Figure 1. PRISMA flow diagram for the review process

## 5. RESULTS AND DISCUSSION

In starting, 90 papers are extracted, and full-text articles were evaluated, in which 50 research papers meet the inclusion criteria were selected. However, these 50 papers were also reduced due to duplication and selected only 30 papers. The method used for this purpose is PRISMA. Due to the COVID-19 that stared in 2019, all published research papers are in 2020 and 2021. These 30 papers are published in different countries in the world like China, the United States, and Saudi Arabia. These research papers used different machine learning algorithms used for the screening, forecast, and detection of COVID-19.

The use of machine learning algorithms has been vastly used in diverse kinds of businesses all over the world in the previous years. Likewise, within the health care business, machine learning has been generally used for diagnosing and screening COVID-19 in the current time. In the medical specialty area, machine learning algorithms are used for understanding epidemics and detecting diseases. In this paper, we presented a complete survey of how machine learning algorithms [20] have been used to detect, screen, and provide security of COVID-19. We try to show how much research had been done yet in machine learning to

screening and detect COVID-19. The researcher uses different machine learning algorithms like (SVM, RF, *k*-NN, linguistic geometry, GBT) for screening this virus. Some algorithms give more accuracy on large data and also improve their results on giving accurate and appropriate data.

While the evaluation of clinical photographs like X-ray and CT-scan [9] with the mixture of different machine learning technology in analysis COVID-19 have given hopeful outcomes, there are some limitations that are essential to be the remark of the principle demanding situations that scientists are facing: insufficient datasets that we use for machine learning algorithms. Furthermore, these public datasets utilized in the distinct machine learning models commonly come from unique clinical photo assets consisting of scientific institutions hospitals, wherein it is hard to follow presence and elimination COVID-19 measures which include symptomatic versus asymptomatic COVID-19 instances, or these photos are taken at brutality stage.

These restrictions convey a shape of ambiguity for machines getting to know algorithms and models which can grip and categorize the COVID-19 infection through clinical images. So, the healthcare experts should also use other assets of testing like RT-PCR [23] to in addition authenticate the consequences. Some of the additional technologies include knowledge-gaining machines based on chatbots, which are designed as scientific experts to support and guide sufferers, are also related with demanding situations. Such sorts of chatbots often cannot use difficult language when talking to patients. The essential, privateness issue would be another check to an affected person give history about a disease with the chatbot to get hold of a right remedy guideline. Therefore, we display privacy and security fears are emphasized concerning the usage of AI primarily based IoT gadgets.

The data available at local sites as well as in different hospitals [20] include X-ray and CT-scan images have been used in most of the papers in which testing and training. These available testing datasets were used to validate the methods. Using SVM, its accuracy goes to 98% while another algorithm gives accuracy almost 85% on the same data. That is why we suggest SVM to use for detection and screening for COVID-19 its results are accurate.

## 6. CONCLUSION

The use of machine learning algorithms has been vastly used in diverse kinds of businesses all over the world in the previous years. Likewise, within the health care business, machine learning has been generally used for diagnosing and screening COVID-19 in the current time. In the medical specialty area, machine learning algorithms are used for understanding epidemics and detecting diseases. In this paper, we presented a complete survey of how algorithms of machine learning have been used to detect, screening, and provide security from COVID-19. We try to show how much research had been done yet in machine learning to screening and detect COVID-19. The researcher uses different machine learning algorithms like SVM, RF, *k*-NN, linguistic geometry, GBT for screening this virus. Some algorithms give more accuracy on large data and also improve their results on giving accurate and appropriate data.

machine learning applications use for multiple purposes, but we firstly focused on how medical imaging data use for to detect and screen COVID-19-related CT-scans and X-rays. One of the main challenges that are faced by the researcher when detecting COVID-19 using machine learning algorithms was the lack of related data that are available to the public. The absence of data means researchers had to use methods like data augmentation, transfer learning, and fine-tuning models to improve forecast accuracy. It is very difficult to use this method to give good results and accuracy. The use of machine learning algorithms is very useful for screening COVID-19 but some issue is related to data gathering because all sources of data or not accurate that way every algorithm that we used for detecting COVID-19 give different results. Most of the researchers use the same method but use different sources for data collection that way results are different. we see when we increase data the accuracy of results also increases accuracy while using SVM its accuracy goes to 98% while another algorithm gives accuracy almost 85% on the same data. The accuracy level of SVM is more than other algorithms therefore we suggest that the SVM is good for detecting COVID-19. Nowadays machine learning is very useful in screening COVID-19 because of its less expensive resources and availability of data.

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